GREEN CHEMISTRY

cience for the 21st Century ***will involve continued research in Green Chemistry***

Upon hearing the words "green chemistry" for the first time, one might get the impression that it deals with chemistry involving plants. In fact, green chemistry encompasses several science fields. But more than anything else, it is a philosophy of constantly searching for ways to do things better — and cleaner.

Paul Anastas, Industrial Chemistry Branch Chief for the Environmental Protection Agency, first coined the phrase "green chemistry" back in 1992. It is defined as "the invention, design and application of chemical products and processes to reduce or eliminate the use and generation of hazardous substances." Over the past several years, international efforts in green chemistry have greatly increased in hopes of combating today's most pressing environmental problems, such as air and water pollution, global warming and ozone depletion. Los Alamos, a member of the International Union of Pure and Applied Chemistry and management organization for the Green Chemistry Institute, has been working with industry and other research institutions worldwide to help solve these and many other problems.

Los Alamos' collaborative efforts in green chemistry already have made tremendous impacts on several industrial sectors. One example is the development of dense-phase carbon dioxide, a multi-award-winning, recyclable solvent that cleans everything from plutonium pits to semiconductor wafers to clothes. Called DryWash in the dry cleaning industry, supercritical CO2 replaces hazardous dry cleaning chemicals such as perchloroethylene, or perc. The Supercritical Carbon diOxide Resist Remover, or SCORR, removes coatings called photoresists from semiconductor wafers, again replacing toxic chemicals. It even is used instead of solvents by the food industry to extract dyes from red chile and caffeine from coffee! Future possible uses for CO2 include making cement stronger and reducing pollution emissions from coal plants.

Another Los Alamos success story is the Advanced Recovery and Integrated Extraction System, or ARIES, as it's more commonly called. ARIES allows workers to separate plutonium from other weapon components during dismantlement. As part of the plutonium recovery process, workers use hydrogen instead of nitric acid to convert the nuclear pit into plutonium oxide, completely eliminating hazardous aqueous waste streams.

Most recently, Los Alamos and Motorola announced the development of a fuel cell for cellular phones that lasts the lifetime of the phone and runs on methanol. Los Alamos is a world leader in fuel cell technology, in which clean, renewable resources are used to convert chemical energy directly into electricity. Los Alamos currently partners with several other businesses in this field, including the Big Three automakers under the Department of Energy's Partnership for the Next Generation of Vehicles Program.

Among the many other current green projects at Los Alamos is a collaboration with Sandia National Laboratories, Dow Chemical, the University of Minnesota and Reaction Engineering International — under DOE's Chemical Industry of the Future Program — to develop an oxidative cracking process for producing ethylene, a major industrial raw chemical. The new process may save up to 13 trillion BTU's of natural gas over conventional hydrocarbon cracking processes and reduce carbon dioxide emissions by up to four tons annually, among other benefits.

The list of current "green" activities at Los Alamos is exhaustive. Some day, it may not be such a stretch to say, "There's a little bit of green in everything Los Alamos does."

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